

FOUR ACALYPTRATE DIPTERA REARED FROM DEAD HORSESHOE CRABS^{1,2}

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ABSTRACT: Four species of acalyptrate Diptera were reared from dead horseshoe crabs: *Hecamede albicans* (Meigen) (Ephydridae), *Conioscinella hinkleyi* (Malloch) (Chloropidae), *Coproica vagans* (Haliday) and *C. hirtula* (Rondani) (Sphaeroceridae). The third instar larvae and puparia of *H. albicans* and *C. hinkleyi* are described, and *Urolepsis rufipes* (Ashmead) (Hymenoptera, Pteromalidae) is reported as a parasitoid of *H. albicans*.

In spring and early summer, the beaches of Delaware Bay in the vicinity of Town Bank, New Jersey, become littered with the carcasses of horseshoe crabs, *Limulus polyphemus* L., which crawl ashore to mate and lay their eggs. The decaying crabs provide an excellent larval substrate for a number of Diptera, including the following four species that I was able to rear: *Hecamede albicans* (Meigen) (Ephydridae), *Conioscinella hinkleyi* (Malloch) (Chloropidae), *Coproica vagans* (Haliday), and *C. hirtula* (Rondani) (Sphaeroceridae). These records probably represent an opportunistic use of this locally abundant, temporary resource, as all four species appear to be generalist scavengers.

The flies developed from fifteen dead horseshoe crabs collected from the beach on June 19 and July 5, 1982. The viscera of most of the crabs were dried up or were previously consumed by muscid and calliphorid larvae, leaving mainly the outer sclerotized parts, muscle, and connective tissue. The crabs were placed with moist sand in rearing jars and were stored at 18-23°C. Water was occasionally added to prevent desiccation. Several crabs were dissected and the dipteran larvae and pupae in them collected and preserved or reared separately to allow association with the adults. This paper presents biological observations on these flies and descriptions of some of their immature stages. The morphological terminology of Teskey (1981) is followed in descriptions of the immatures. All specimens studied, unless otherwise noted, were deposited in the Frost Entomological Museum, The Pennsylvania State University or the National Museum of Natural History, Smithsonian Institution, Washington, D.C.

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Hecamede albicans (Meigen)

H. albicans is a common maritime ephydrid found from Massachusetts to Maryland and also in Europe (Wirth 1965). It has been reared previously from rotting lettuce and excrement (Simpson 1976 and pers. comm.) and its congener, *H. persimilis* Hendel, has been found in "foul smelling sand beneath a human carcass" (Bohart and Gressitt 1951) and bred from seaweed (Tenorio 1980). Both species probably develop in a wide range of decaying organic materials.

Adults of *H. albicans* were very common on the dead horseshoe crabs, walking about on their surface and crawling inside them. They frequently extended their mouthparts to feed, or perhaps simply to obtain moisture. Over 200 individuals were reared from the crabs. The larvae were present mainly between the gills and on other moist membranous surfaces, and pupation occurred within the crabs, in the sand, and on the sides of the rearing jar. Descriptions of the third instar larva and the puparium are given below. In both stages, *H. albicans* is very similar to *H. persimilis* (see Bohart and Gressitt 1951; Tenorio 1980), but the tentoropharyngeal sclerite tapers more gradually anteriorly and there are 3 pairs of tubercles on the last segment of the larva.

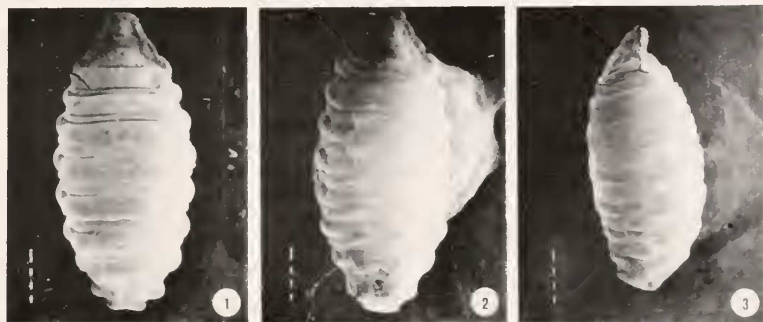
One pupa of *H. albicans* was parasitized by the pteromalid *Urolepsis rufipes* (Ashmead). This wasp previously has been reared from two western Nearctic ephydrids, *Hydropyrus hians* (Say) and *Setecera pacifica* (Cresson) (Burks 1979).

Third Instar Larva (Figs. 4-9): Opaque white; length 4.00 - 4.50 mm; cylindrical, tapering anteriorly, truncate posteriorly. Cephalic segment bilobed anteriorly; antenna (Fig. 5) two segmented, basally surrounded by broader membranous evagination; cephalopharyngeal skeleton about 0.65-0.70 mm long; mandibles (Figs. 6-7) strongly sclerotized, separate, strongly curved anteriorly, with short ventral process at about their midpoint, and with small circular window present at base of ventral process; hypopharyngeal sclerite strongly sclerotized; parastomal bar very slender, not connected posteriorly to tentoropharyngeal sclerite; tentoropharyngeal sclerite gradually tapering anteriorly to acute apex, broad between cornua, strongly sclerotized medially and anteriorly, gradually weakening dorsally, ventrally, and on apical half of ventral corua; dorsal cornu with small window apically; ventral cornu with larger mesally bent window dorsally near base; pharynx ventrally with longitudinal ridges, and with 2 small dark spots near tips of ventral cornua; anterior spiracle (Fig. 8) short, fan-shaped, six-lobed. Posterior spiracle tube short and cylindrical, slightly projecting in lateral view; spiracular plate (Fig. 9) moderately sclerotized, with inner margins of 3 spiracular openings and ecdysial scar indistinct, and with 4 sets of fine, many-branched hairs. Terminal body segment with 3 pairs of small tubercles (Fig. 4), 1 pair dorsolaterally, 1 pair ventroapically, and 1 pair ventrolaterally.

Puparium (Figs. 1-3): Medium brown, partially translucent; length 2.25 - 2.75 mm, width 1.00 - 1.25 mm. Segmentation obvious, delimited by distinct transverse sutures and ridges. Posterior spiracles very short.

Conioscinella hinkleyi (Malloch)

The chloropid *C. hinkleyi* occurs from Kansas and Pennsylvania south to Georgia and Louisiana (Sabrosky 1965). Kulman (1965) has reared it previously from tents of the eastern tent caterpillar, *Malacosoma americanum*



Figs. 1-3. *H. albicans*: puparium in dorsal, ventral, and lateral views.

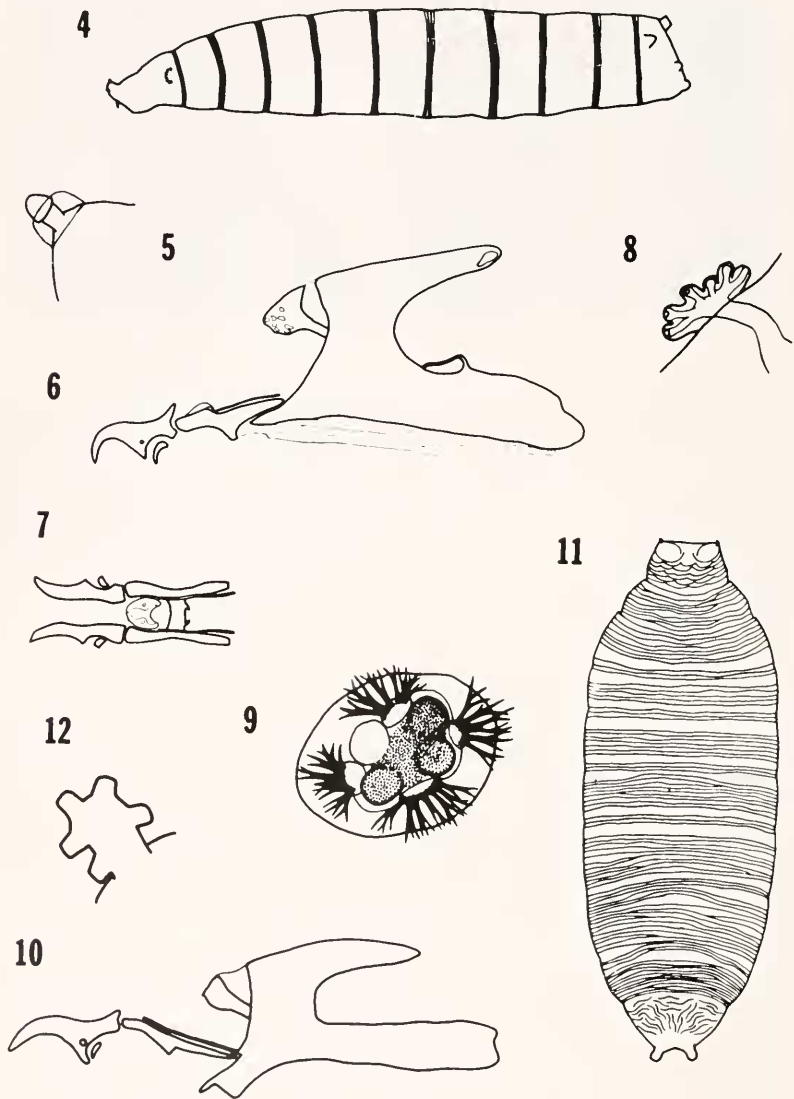
(F.), and Berisford and Tsao (1975), from larval cases of the bagworm *Thyridopteryx ephemeraeformis* (Haworth). Two females were reared in this study; the pupal stage of one was observed to last 7 days. An adult female was also collected on a dead horseshoe crab, and a pupa which failed to develop was found lying on the sand beneath a crab. A phoretic hypopus of a histiostomatid mite was present on the captured adult. Descriptions of the puparium and the remains of the cephalopharyngeal skeleton of the third instar larva are given below.

Third Instar Larva: Cephalopharyngeal skeleton (Fig. 10) about 0.45 mm long; mandibles separate, strongly sclerotized, narrow and slightly curved anteriorly, with narrow ventral process arising just behind middle, and with small circular window present at base of central process; hypostomal sclerite moderately sclerotized; parastomal bar extremely slender, connected to tentoropharyngeal sclerite posteriorly; tentoropharyngeal sclerite weakly sclerotized, especially cornua, anteriorly tapering to finger-like process; dorsal and ventral cornua apparently without windows; pharynx with longitudinal ridges.

Puparium (Fig. 11): Very light golden brown, translucent; length 2.40 mm, width 0.85 mm. Surface transversely by numerous thin, wrinkle-like ridges. Anterior spiracle (Fig. 12) small, with about 5 short lobes. Posterior spiracles slightly projecting.

Coproica vagans (Haliday)

C. vagans is a very common, cosmopolitan sphaerocerid frequently found on dung and compost (Richards 1973). Coffey (1966) reared it from chicken, horse, cow, and pig excrement and collected adults on mink droppings. I have also reared it from CMSA media (putrefying mixture of alfalfa meal and wheat bran). Adults of *C. vagans* were very common on the dead horseshoe crabs and larvae and pupae were present mainly in the gills and other moist membranous parts. Over 300 individuals were reared. A second generation also developed in the same crabs, although fewer in number than the first generation. Complete development in the crabs and in the CMSA media required 19-23 days, 14-17 for the egg and larval stages and 5-6 for the pupal stage. Goddard (1938) previously described the cephalopharyngeal skeleton of the third instar larva of *C. vagans*, as well as the puparium which is nearly transparent.



Figs 4-9. *H. albicans*: third instar larva; 4 - lateral habitus; 5 - antenna; 6 - cephalopharyngeal skeleton, lateral view; 7 - mandibles, hypopharyngeal sclerite, dorsal view; 8 - anterior spiracle; 9 - posterior spiracular plate.

Figs. 10-12. *C. hinkleyi*: 10 - third instar larva, cephalopharyngeal skeleton; 11 - puparium, dorsal habitus; 12 - puparium, anterior spiracle.

Coproica hirtula (Rondani)

C. hirtula is also a cosmopolitan sphaerocerid, very similar in habit to *C. vagans*, being frequently found in association with dung and refuse of confined animals (Richards 1973). Coffey (1966) reared it (as *Leptocera exiguella* sp. A) from cow, pig, chicken, human, and mink excrement and collected it on sheep dung. A single male emerged from the dead horseshoe crabs.

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